Pricing Unscheduled Flows as a Way to Get Competition to Enhance Reliability: A Response to Solicited Issue Papers on Reliability and Competition

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"We must all hang together, or assuredly we shall all hang separately." Ben Franklin, 1776 July 4, comment attributed to him upon the signing of the *Declaration of Independence*

"Due to the interconnected nature of the grid, transmission operators within each interconnection are essentially hostages to one other; if one fails to do the right thing, all others suffer the consequences." José Delgado in "The Blackout of 2003 and its Connection to Open Access"

The free flowing nature of our AC system permits unscheduled flows of electricity, a concept that can be called tie-riding. Tie-riding results in high reliability at low cost. But because we do not yet charge for tie-riding, we have freeloaders. Freeloaders can be considered to be those participants who, on balance, ride the ties more than they support the system. However, identifying that balance has proven to be elusive for the industry in the context of a competitive market. These freeloaders have caused competition to degrade reliability.[1]

The problem is not the physical grid. Nor is the problem the unscheduled flows that result from the physical grid. Instead, the problem is that industry has not implemented a method to price unscheduled flows of electricity in a way that participants are paid for their geographically differentiated real time contribution to the reliability of the grid. Instead, participants are allowed to freeload by riding the ties at no charge.

Investors put money into utilities to make a profit. Some people have described these investments as being related to either economics or to reliability. Investments for economic purposes obviously should be making money for investors. The electric industry needs a way for **reliability driven investments to make money** for investors. The industry should pay for unscheduled flows of electricity using operating reliability indices to set the prices for these unscheduled flows. That requires better revenue accounting mechanisms to pay for the unscheduled flows, especially the unscheduled flows that improve reliability. The result will be that tie-riders don't get away with freeloading.[2]

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[1] See "Tie Riding Freeloaders--The True Impediment to Transmission Access," *Public Utilities Fortnightly,* 1989 December 21.

[2] See "Power Crisis: Revenue Accounting Needed: An Issue Paper on the U.S. Northeastern Blackout, August 14, 2003," *Energy Pulse*, http://www.energypulse.net/centers/article/article_display.cfm?a_id=521, 2003 October 28.

RELATING TO THE COMMENTS IN THE PRINCIPLE PAPERS

The physics of the electric grid facilitates allow what economists call the "externalization of internalities," getting other participants to help with one's problems, especially without paying for that help. As José Delgado, President & CEO, American Transmission Co., said in "The Blackout of 2003 and its Connection to Open Access"

> (d)ue to the interconnected nature of the grid, transmission operators within each interconnection are essentially hostages to one other; if one fails to do the right thing, all others suffer the consequences.

Certainly, Mr. Delgado's comments echo the famous words of Ben Franklin, "We must all hang together, or assuredly we shall all hang separately." Under the historic mode of operation, utilities treated each other as members of an Old Boys Club.[3] Restructuring was meant to change the Old Boys Club, by making the industry more nearly a competitive market.

THERE SHOULD BE PROFIT

Jack Casazza, Frank Delea, and George Loehr in "Contributions of the Restructuring of the Electric Power Industry to the August 14, 2003 Blackout" frequently refer to immediate profits as the antithesis to long term reliability. These points may be valid under the current system, where participants can be freeloaders by riding the ties with no payment for doing so. However, when participants pay for externalizing their internalities there will be a way for others to earn the needed immediate profits while improving reliability.

In a similar manner, John Wilson on behalf of Ontario Electricity Coalition in "Sinister Synergies: How Competition for Unregulated Profit Causes Blackouts" told of the new owner of a hydroelectric facility draining the storage behind the dam to make a profit in a way that decreased electricity reliability. Similarly, Dave Goulding, President and CEO of the Independent Electricity System Operator of Ontario, Canada, repeated this allegation in "Competitive Power Markets and Grid Reliability: Keeping the Promise" as

> (s)hort-term profit maximization in competitive electricity markets will lead firms to run their equipment too long and hard or to cut costs in potentially irresponsible ways, thereby impairing reliability.

Reliability issues should be included in the setting of prices for unscheduled flows of electricity. Such reliability driven prices would provide incentives for operators to balance profit **today** with possible profit **tomorrow** when reliability might be threatened even more. A side effect of such immediate profits will be allegations of gouging, whether the profits occur today or the profits occur tomorrow.

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[3] See "Inadvertent Interchanges -- A New Way to Price Unscheduled Electricity," *Electrical World,* December 1991 and "Competition Versus the Good Old Boys' Club," Forum, *IEEE Computer Applications In Power*, January 1997.

Mr. Delgado suggests a certification process for officials. Mr. Delgado's idea is based on the fact the new leaders in the electric industry are businessmen, not engineers. Perhaps the problem is that the electric industry needs instead to develop a business model that conforms to the industry's reliability concepts, a business model that the businessmen can understand. Considering the political mandates for markets, the industry should develop a business model that reflects our most valuable product, reliability.

RELIABILITY DRIVEN PRICES

As mentioned before, Mr. Wilson and Mr. Goulding both commented about how profits today jeopardized system reliability later. The conflict between profits and reliability need not exist. Reliability concerns can be used to drive the price for unscheduled flows of electricity. High prices during periods of high concern about reliability make the profit concern match the reliability concern.

Phillip G. Harris of PJM Interconnection LLC wrote "Relationship between Competitive Power Markets and Grid Reliability: The PJM RTO Experience" in which he decried the lack of methods to measure bulk operating reliability, pointing to SAIDI and SAIFI as ways to measure distribution operating reliability. But these are after the fact measurements. Conversely, the standard bulk reliability index is one day in ten years, which is a planning index.

In contrast to Mr. Harris complaint about the lack of operating reliability indices, John P. Hughes of the Electricity Consumers Resource Council pointed to NERC's investigation of frequency excursions in "Reliability Risks During the Transition to Competitive Electricity Markets." Frequency is indeed a way to measure the operating reliability of the bulk power system. NERC's Joint Inadvertent Interchange Task Force even said that frequency should be used as a way to modify LMP to reflect reliability issues. But NERC has not led the industry to act on the recommendations of NERC's own task force.

Mr. Wilson has decried the decrease in joint planning and coordination. That decrease in cooperation may be true on a planning basis, but the AC nature of the electric system results in everyone seeing the same frequency, at least so long as the system hangs together. The industry needs to take advantage of this coordinated frequency as a reliability measurement in the process of setting prices for unscheduled flows of electricity.

A second reliability measure is voltage. Voltage is not consistent throughout the network, as was demonstrated by Robert J. Thomas, Professor, School of Electrical and Computer Engineering, Cornell University in "Managing Relationships Between Electric Power Industry Restructuring and Grid Reliability." Prof. Thomas presented figures he reproduced from a presentation by Terry Boston, a vice president at Tennessee Valley Authority. The voltages vary across the map but are consistent on either side of the meter separating two utilities. This can be used to set the price for reactive power delivered between parties.

David R. Nevius and Ellen P. Vancko of North American Electric Reliability Council urge mandatory reliability standards in "Ensuring a Reliable North American Electric System in a Competitive Marketplace." A better approach would be to use reliability measurements to set

the price for unscheduled flows of electricity. This concept was supported by NERC's own Joint Inadvertent Interchange Task Force. In some respects, imposing mandatory reliability standards is like legislating morality. It didn't work for prohibition and is unlikely to work for electricity. A better approach is an appropriate structured "sin tax", such as a payment for unscheduled flows of electricity.

In many respects, reliability measurements can be considered to be the public goods discussed by Prof. Thomas. Prof. Thomas pointed specifically to spinning reserve as a public good for which many market participants believe they should not have to pay. But reserves can be treated as an insurance product, with real time charges to those participants who draw on spinning reserves without being a participant in the insurance pool.[4] This is an explicit example of how to develop a business model for a reliability issue.

GEOGRAPHIC DIFFERENTIATION

Payment for unscheduled flows of electricity should include the payment for the use of transmission lines and for reactive power. Since reactive power "doesn't travel far", payment for unscheduled flows of electricity will necessarily be locational. Similarly, payment for the use of transmission lines would reflect the difference between the value of the power entering the lines versus the power leaving the lines. This requires locational prices.

Mr. Harris also wrote that locational marginal prices (LMP) would have revealed the problems in Northeastern Ohio in time to have prevented the August 2003 blackout. Unfortunately the seams agreement between PJM and its neighbors do not include a provision for LMP for the loop flow existing between and among PJM and its neighbors. Just having LMP prices in Northeastern Ohio would not have been sufficient unless PJM were willing to pay First Energy for the loop flow through PJM coming from First Energy.

Mr. Goulding points out that Ontario prohibits geographically differentiated prices, an important aspect of LMP. During the few minutes before the August 2003 blackout, Ontario provided a transmission path for significant amounts of loop flow.[5] A payment mechanism for unscheduled flows of electricity would have compensated Ontario for its efforts to keep the system together, whether those efforts were intentional or the efforts were unintentional. That the efforts were unintentional and merely the results of the physics of the system can be presumed from the description of the surges of electricity through the Ontario system. That they were merely the

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[4] See "Metrics for Operating Reserves," *The National Regulatory Research Institute Quarterly Bulletin*, Spring 1998. This paper was the prepared remarks at the Secretary of Energy Advisory Board Task Force on Electric System Reliability meeting of 1998 January 13. Also, "Keeping the Lights On: An Insurance Industry Model . . . to Stop Manipulation," *Public Utilities Fortnightly*, 2002 July 1.

[5] See "Power Crisis: Revenue Accounting Needed: An Issue Paper on the U.S. Northeastern Blackout, August 14, 2003," *op. cit.*

results of the physics of the system does not detract from the payments Ontario would have gotten under a system of payment for unscheduled flows of electricity.

Mr. Hughes has claimed that "organized markets" have increased congestion, especially for the systems adjacent to those "organized markets," a concept called loop flow, or parallel path flow in special cases. In regard to parallel path flow, Mr. Hughes cited the calls for Transmission Line Loading Relief (TLR) on NIPSCo associated with AEP joining PJM. Mr. Hughes also discussed the potential for a difference between transmission investments made for economic reasons versus those made for reliability reasons.

Kellan Fluckiger, Alberta Department of Energy, in "Competitive Electric Power Markets and Grid Reliability, something has changed over the past decade!" raised the issue of merchant power lines, which former FERC Commissioner Wood believes should achieve rate recovery. The previously mentioned parallel path flow is one of the impediments to merchant power lines achieving rate recovery. Tariff differentials on competing parallel paths result in over scheduling on the path with cheaper fixed tariffs and with overloads on the more expensive path. LMP for unscheduled flows on all lines, including the overloaded lines, would reduce the incentive for owners of parallel paths to over schedule the use of their lines.

Mr. Fluckiger's concept of merchant power lines may be difficult to implement in his province of Alberta. Scott Thon of AltaLink wrote "Alberta Electric Industry Restructuring, Implications for Reliability" in which he describes the provincial decision against LMP. LMP is a market approach which can encourage merchant power lines. However, Mr. Thon also wrote of the decision that the province would seek to minimize the cost of transmission constraints. Such a policy can result in transmission lines being built as rental properties instead of competing in an LMP based market.

REACTIVE POWER

Complicating the LMP issue in regard to the August 2003 blackout is that a major problem was the reactive power necessary for voltage support. There is now no mechanism in place to pay for reactive power on a locational real time basis, especially the unscheduled flow of reactive power. "Principles for Efficient and Reliable Reactive Power Supply and Consumption," the 2005 February 4 staff report that began FERC Docket AD05-1, only discusses paying for the investments related to the ability to produce reactive power, not LMP for reactive power.[6]

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[6] See "Wide Open Load Following: Mark Lively's Approach to Pricing Reactive Power," *Carnegie Mellon University Electric Industry Center Luncheon Seminar*, 2004 December 2, as modified from a presentation to FERC Staff on 2004 October 25 as a member of the IEEE-USA Energy Policy Committee, and "Comments Of Mark Lively, Utility Economic Engineers, Including Answers And Comments To Questions In Staff Report Of 2005 February 4," filed in *Principles for Efficient and Reliable Reactive Power Supply and Consumption*, FERC Docket No. AD05-1-000, 2005 April 4.

Prof. Thomas wrote

> (e)lectric power networks offer multiple simultaneous commodities, and there are a variety of externalities, such as reliability concerns, that imply that a pure market solution is unlikely to be efficient. In addition to the complications presented by the network itself, the unbundling of ancillary services suggests the existence of multi-dimensional markets where the sale of many related goods will take place.

In practice, there are now only two measurable commodities, active power and reactive power.[7] All other products discussed by Prof. Thomas can be shown to be hedges against the delivery of these two commodities.[8] Indeed, the insurance model discussed earlier with respect to operating reserves can be considered to be a hedge.

Mr. Goulding made a point that participants in most of the developed markets have an opportunity to hedge their purchases. That opportunity has been severely restricted in most of the restructured markets. One of the best ways that utilities and their customers have found to hedge against market volatility has been the outright ownership of power plants. This right has been denied major utilities in the restructuring process. A second common method to hedge against volatile prices has been long term contracts with a vertically integrated utility, such as those contracts signed by municipal utilities and cooperatives with local investor owned utilities. Again, this right has been denied major utilities in the restructuring process.

CONCLUSIONS

There needs to be a way for the industry to make a profit. Reliability can be enhanced if we connect prices for unscheduled flows of electricity to concurrent reliability indices. These reliability indices need to be geographically differentiated and reflect the effect on reactive power.

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[7] See "Thirty-One Flavors or Two Flavors Packaged Thirty-One Ways: Unbundling Electricity Service" *The National Regulatory Research Institute Quarterly Bulletin*, Summer 1996. This article originally appeared as comments titled "31 Flavors or Two Flavors Packaged 31 Ways," *Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities,* FERC Docket RM95-8-000, 1995 November 2.

[8] Note that the growing concern about power quality may result in the third harmonic (at 180 Hertz) being treated as a commodity, or the fifth harmonic (at 300 Hertz). Both can be considered to be special cases of reactive power.